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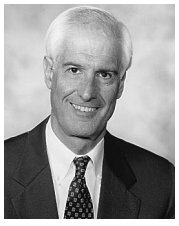

President's Page: Geographic Variations in Delivery of Cardiovascular Care: An Issue of Great Importance to Cardiovascular Specialists

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Two years ago, the American College of Cardiology (ACC) joined with the Society of Thoracic Surgeons (STS) and the publishers of the *Dartmouth Atlas* series to take a hard look at practice variation, or the rates at which different cardiovascular procedures are used throughout the U.S. When the College decided to co-sponsor this project, it is unlikely that anyone realized just how enlightening the results would be. *The Dartmouth Atlas of Cardiovascular Health Care* (1) is not only the first specialty-specific volume in the series, but it also represents one of the first times the profession has looked at itself in the mirror and seen just how much utilization of cardiovascular procedures varies throughout the U.S. The *Atlas* represents a comprehensive evaluation of health care services provided to Medicare patients with cardiovascular disease at the regional and national levels. The data analyzed came from Medicare claims for 1996. In the preface to the *Dartmouth Atlas*, the ACC and the STS stated that they worked with the *Atlas* investigators because they believed that "the variations in treatment patterns that are evident in the delivery of care are important to understand, particularly as this understanding can lead to an improvement in the care of patients with cardiovascular disease." Both organizations are committed to identifying the explanations for geographic variations in the use of diagnostic tests and therapeutic interventions. Other stakeholders confronting variation are the federal government and insurance companies.

The Dartmouth Atlas of Cardiovascular Health Care (1), published this spring, is a nearly 300-page compilation of charts, maps and text describing geographic variations in the cardiology work force, as well as patterns related to the use of diagnostic, interventional and surgical procedures. It should be recommended reading for every cardiovascular specialist, because understanding the implications of the findings in this volume is a first step in improving the quality of care of cardiovascular patients.

Variation exists. As noted in the *Atlas*, it is the high prevalence of coronary artery disease (CAD) and the wide range of technology applicable to cardiovascular care that make geographic variation patterns so interesting and so telling. Perhaps the most significant finding in the *Atlas* is this: "The likelihood that a patient with coronary artery disease will have a particular test or procedure depends in large measure on where the patient lives and seeks care."

One good example on the diagnostic front is stress testing, a procedure that is the subject of some debate, as well as an ACC/American Heart Association (AHA) consensus document (2). The *Atlas* characterizes the rates of total stress testing as "highly idiosyncratic and not geographically uniform." Regions with high rates were often contiguous with regions with much lower rates. Among the 35 regions with rates at least 30% higher than the national average were areas in Michigan, Louisiana and California. Rates of total stress testing (imaging and nonimaging) ranged from ~25 to ~150 per 1,000 Medicare enrollees, after adjustment for differences in population age, gender and race. Use of imaging studies (nuclear cardiology or echocardiography) varied by a factor of more than 10 in 1996, ranging from ~10 per 1,000 Medicare enrollees to nearly 120. This regional variation is quite remarkable. For example, the rate of imaging stress testing was 119.4 in St. Joseph's, Michigan, as compared with 11.2 in Tacoma, Washington—a difference of more than tenfold! Interestingly, there was no significant inverse correlation between imaging and nonimaging stress tests, so that regions with a high rate of imaging stress tests did not tend to have a lower rate of nonimaging tests. Thus, one test (with imaging) is not being substituted for another test (without imaging).

Variation exists in interventional cardiology, too. For percutaneous coronary interventions as a whole, the average was 7.5 per 1,000 Medicare enrollees, but the rates in New England, New York, Washington and Oregon were lower than average. Rates of angioplasty ranged from <3 to >20 per 1,000 Medicare enrollees, after adjustment for differences in the age, gender and race of the local populations. Fifty-seven hospital referral regions had rates at least 30% higher than average, and 68 regions had rates at least 25% below average. Variability in the rate of revascularization could not be explained by variability in the rates of CAD. The rate of revascularization did correlate, however, with the rate of diagnostic coronary angiography ($R^2 = 0.87$). For every two coronary angiographic studies performed, one revascularization occurred. Although this relationship may seem obvious, what is fascinating is that the tight linear

relation existed at all levels of coronary angiography, whether the rate was 15 per 1,000 or 60 per 1,000 Medicare enrollees.

The next question that can be asked is why is there so much geographic variation in the rates of coronary angiography? Rates range from ~10 to ~60 per 1,000 Medicare enrollees in the 306 hospital referral regions canvassed. Dr. David E. Wennberg, Principal Investigator of *The Dartmouth Atlas of Cardiovascular Health Care*, found that the rates of coronary angiography showed a correlation with the number of invasive cardiologists per 100,000 residents who perform coronary angiography, but no relationship with the number of general noninvasive cardiologists. A moderately strong relationship also exists between the supply of cardiac catheterization laboratories per 100,000 residents of hospital referral regions and rates of cardiac catheterization per 1,000 Medicare beneficiaries. In another publication by Dr. David Wennberg (3), it was calculated that in northern New England, an increase of one catheterization laboratory per 100,000 population was associated with an increase in the angiography rate of 1.62 per 100,000 population. Thus, the more invasive cardiologists per 100,000 individuals and the more catheterization laboratories that operate in a region, the greater the probability of a person having a coronary angiogram followed by a percutaneous coronary intervention or coronary artery bypass graft surgery.

The *Atlas* is by no means the only work done in the area of geographic variation in health care. As Dr. John E. Wennberg has pointed out, "Geographic variations in health care delivery have been widely documented in the United States, Canada, Europe, and Australia" (4). For example, a study by O'Connor et al. (5) found considerable variability in the treatment of patients who had an acute myocardial infarction. Particularly wide ranges of administration were found for reperfusion therapies (33.0% to 93.3%) and for angiotensin-converting enzyme inhibitors (6.7% to 100%). This study also documented considerable regional variations in the use of thrombolytic agents, beta-blockers and aspirin. Lucas et al. (6) found marked geographic variation in echocardiography rates in a sample of Medicare patients. Echocardiography rates varied from 5% of the Medicare population in Oregon to 15% in Michigan. Large variation in rates were seen in urban areas, with one of four Medicare beneficiaries in Miami receiving echocardiography—a rate four times greater than that in Seattle. Thus, the likelihood of Medicare beneficiaries having echocardiography is certainly influenced by where they live.

What does variation mean? Clearly, variation exists and, thanks to publications like the *Dartmouth Atlas* series, a great deal of that variation is documented. In many ways, that is the easy part. The hard part—the part in which physicians must play an integral role—is interpreting the variation, determining whether and where the variation is inappropriate and then making changes. As Dr. David Wennberg has noted, "We must take an active role in the debate about variation in practice patterns. If we do not, we will cede our role as professionals and become mere technicians." (7).

A starting point in this debate should be the fact that, although variation patterns are extremely interesting, they mean very little in and of themselves. They must be interpreted in relation to numerous factors. Next are expectations. Third-party payers, the federal government, the media, patients and physicians all need to realize that some variation is both reasonable and to be expected. Medicine is, after all, an art as well as a science. An extremely important aspect is the individual physician's *judgment* about what is best for each patient, who is likely to have a somewhat unique constellation of symptoms as well as personal preferences about his or her care.

In other words, there are legitimate variations in the practice of medicine and, specifically, utilization of procedures. Physicians' judgment is likely to be influenced by a variety of factors, such as work culture. The *Atlas* reveals trends that imply that certain areas tend to be more conservative, whereas others are more aggressive. Certainly, these trends affect physicians' judgment, but so do even more entrenched cultural elements—many of which are not explicitly studied during research on practice variation. Some geographic areas may be more heavily populated by patients who are medically savvy and likely to demand the newest, most innovative and perhaps most recently publicized treatment. Other areas might have more traditional populations, where age, religion, gender or other factors might influence the patients or their families to resist newer therapies. However, studies that have assessed the contribution of consumer demand to variations in treatment have not found a close link.

I believe that "opinion leaders" influence rates of diagnostic and treatment procedures in various geographic regions. Such authorities may impart certain points of view regarding value and limitations of diagnostic and treatment options for patients with cardiovascular disease. In one region, one or two such authorities might convey to other cardiologists and primary care physicians the great worth of invasive strategies in the initial evaluation of patients with chest pain, whereas in other regions, opinion or thought leaders might persuade their colleagues that noninvasive imaging stress testing should be the initial step in evaluation of patients with chest pain and suspected CAD.

Cardiology fellowship training programs may also play a role in contributing to geographic variation in rates of procedures per 1,000 patients, by emphasizing certain strategies over others. Trainees often end up practicing in the geographic regions in which they train and continue engaging in practice patterns similar to those assimilated during training.

Patients also influence rates of procedures. For example, regions comprising more affluent residents might show a higher rate of electron-beam computed tomography for CAD screening, because this test is not yet covered by Medicare and ultrafast computed tomographic scanners

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exist primarily in large urban areas where testing is marketed directly to the public.

Related to the patients themselves are other variables that might influence the study of practice variation. Everyone entering the debate on practice variation should acknowledge that research findings might be influenced by the underlying need for a given procedure. That is the nature of a study on small-area variation. For example, if the study zeroes in on a small area that happens to have a large population of elderly residents, then there is likely to be a legitimate need for more of one type of treatment, such as coronary artery bypass graft surgery, and less of another, such as ablation therapy for supraventricular tachycardia. Other risk factors, such as ethnicity, gender, smoking and access to specialty care, may also influence the rates of more advanced CAD, requiring revascularization. The *Atlas* data, however, are adjusted for differences in age, gender and ethnicity. Also, the data published in the *Atlas* show that geographic variation in diagnostic catheterization and interventional procedures cannot be explained by differences in the rates of CAD.

Despite the potential limitations of studies on practice variations, the findings from these studies cannot be dismissed, must be analyzed thoroughly and must be understood so that the quality of patient care will improve. Dr. David Wennberg has stated, "For medical care, geography is destiny." (7), and that is why physicians must get to work—because geography should not dictate a patient's medical destiny.

How does practice variation interact with quality? Dr. David Wennberg has also written, "Variation can no longer be seen as a mere intellectual curiosity." (7). He is right, because the underlying message in *The Dartmouth Atlas of Cardiovascular Health Care* is that as practice varies, so does the quality of care physicians deliver. Variation in diagnostic and treatment modalities can influence quality in many ways. A lower rate of aspirin or beta-blocker use in a region would increase the rate of cardiac mortality and reinfarction in patients who experienced an initial uncomplicated myocardial infarction. A lower rate of revascularization in high-risk patients with multivessel disease and depressed left ventricular function could contribute to an increase in mortality or morbidity. A high rate of invasive procedures in low-risk patients could adversely affect quality and certainly increases cost unnecessarily. Peterson et al. (8) studied 33,641 men with acute myocardial infarction cared for through the Department of Veterans Affairs, a setting in which the insurance barriers to care are removed. After adjusting for patient and hospital characteristics, blacks were less likely to undergo cardiac catheterization (odds ratio [OR] 0.67, 95% confidence interval [CI] 0.62 to 0.72), bypass surgery (OR 0.46, 95% CI 0.40 to 0.53) and percutaneous transluminal coronary angioplasty (OR 0.58, 95% CI 0.48 to 0.66) than whites. The use of cardiac revascularization after receiving coronary angiography was much lower for blacks (OR 0.59, 95% CI 0.51 to 0.69 for bypass surgery; OR 0.69, 95% CI 0.58 to 0.82 for coronary angioplasty).

Socioeconomic factors and insurance coverage, like gender and ethnicity, also contribute to geographic variation and differences in quality and cost. The age-adjusted cesarean section rates for insured women were significantly higher than those for women with Medicaid and uninsured women (9).

As mentioned previously, the first step is entering the debate, which is something the ACC has done by cosponsoring publication of the *Atlas* and partnering with the AHA in a Joint Task Force on Performance Measures. The development of evidence-based clinical practice guidelines is aimed at standardizing care, which should reduce geographic variation in practice patterns. Enhancing the educational initiatives of the ACC to focus on the dissemination of practice guidelines in a form that is useful for practicing cardiovascular specialists should reduce geographic variation of diagnostic and treatment modalities. Being able to keep such guidelines current as new evidence from clinical trials is made known will be of paramount importance. Distributing new information in a timely manner and in usable form through the Internet will improve standardization of care.

The next step is to acknowledge that the "average" number of procedures is probably not the ideal measure. More appropriate would be to identify an optimal utilization range for each procedure, given the factors that may be in play in given communities. This endeavor will also require that we learn to communicate with our patients in a manner that allows them to make informed medical decisions, particularly when there may not be a "right rate." For example, medical therapy and a coronary intervention may both be appropriate for patients with class I or II angina. The "right" treatment will require active participation on the part of the patient in choosing what they want. Once that range is determined, then physicians and others need to look at the variation that exists and consider whether that variation extends outside of the range and, therefore, beyond what is legitimate.

If too many or too few procedures are being performed in some areas, then research must turn from the facts about procedural variation to the reasons for it. Learning *why* will be at the core of implementing changes and improving care. Opportunities to improve care are likely to proliferate from that point, with the ACC's educational expertise intersecting with its mission of fostering optimal cardiovascular care and disease prevention.

Acknowledgment

I am grateful to Dr. David E. Wennberg, the Principal Investigator of *The Dartmouth Atlas of Cardiovascular Health Care*, for reviewing this report. To obtain a copy of the *Atlas*, contact the American Hospital Association at (800) 242-2626 (order no. 044500) or visit the ACC Web site at http://www.acc.org.

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